# Accessing NOAA Daily Temperature and Precipitation Extremes Based On Combined/Threaded Station Records

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ThreadEx
Long-Term Station Extremes for America
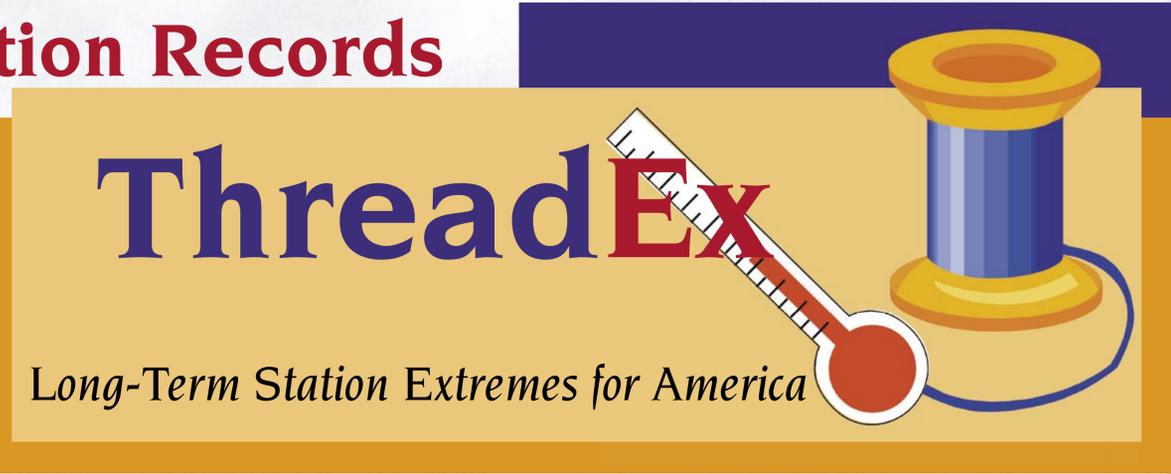
ABSTRACT

Daily records of both temperature and precipitation are of great interest to the public and many data users and are beneficial in climate perspectives. However, numerous station relocations over the years has resulted in inconsistent approaches to combining multi-location data sets, resulting in disparate reporting of record and extreme values at many prominent large metropolitan observing sites. To address this challenge, the methodology for establishing multi-location combined (or threaded) station data sets under the so-called "**ThreadEx**" project is presented.

1. INTRODUCTION

In the interest of ensuring consistent reporting of climatological data, NOAA's National Climatic Data Center (NCDC), in partnership with the Northeast Regional Climate Center (NRCC), NOAA's National Weather Service/Climate Services Division (NWS/CSD), and numerous data users, has established a data set of combined (or threaded) period of record daily temperature and precipitation values at 255 NOAA published *Local Climatological Data* (LCD) locations that generally correspond to most medium- and large-sized cities in the United States. This new ThreadEx data set provides a consistent basis for the reporting of daily extremes for the longest period of time meaningful. The development of this data set is especially timely given the increasing availability of historic daily values in digital form for the first half of the 20th century (and earlier in some cases) (Kunkel et al., 1998; Guttman, 2002).

Many research applications rely on using a variety of homogenization techniques to account for non-climatic shifts resulting from station relocations, changes in instrument type, and variations in the time of observations (DeGaetano *et al.*, 2002). The ThreadEx project aims to report the *actual* values for a given region mapped to a given published LCD site for the express purpose of conveying general climate perspectives information. Thus, the daily values are preserved in spite of siting changes.

2. METHODOLOGY

Threads for a given published LCD will be developed as follows. The record of a currently active station will be the starting point for a station thread. This station's current record will be used as far back in time as possible, taking precedence over a closed station's record during any periods of overlap (for Automated Surface Observing System (ASOS) locations, this period of record is generally very short – no more than 12 years). A search will be conducted to identify other weather stations in the region that can be used to extend the thread further back in time. In this process, preference will be given to Weather Service/Bureau stations over volunteer COOP stations. The thread will be extended back in time as far as possible using NOAA daily data available in digital form.

For historic overlaps, all else being equal, the station with a more recent record will take precedence, unless partner input (*e.g.*, NWS field offices, State Climatologists, *etc.*) with compelling documentation determines otherwise. An attempt will be made to fill any gaps larger than six months in a station record with data from another station. Partner input will be sought during the development of this data set through a survey.

The period of record used for each portion of a thread will be clearly denoted in the station meta-data. An example of a station thread for the Chicago area would be:

Chicago O'Hare AP   11/1/1958 - present
Chicago Midway AP   1/1/1942 - 10/30/1958
Chicago University   1/1/1926 - 12/31/1941
Chicago (COOP)   1/1/1896-12/31/1925
Chicago (CRB)   10/9/1871-12/31/1895

The rain gage at U.S. Smelting Company cooperative weather station Midvale, Utah (circa 1930

Using a teletypewriter to transmit weather information

3. DATA SET ACCESS

The threaded data will be available in two formats:

• On xmACIS (the NWS interface for climate record queries) and other systems using the ACIS database (http://www.rcc-acis.org/), the threaded data station daily values will be fully available for query; thus, all data summaries currently available in xmACIS can be applied to this data set. These stations will be clearly identified as threaded stations.

The benefit of an extended record is illustrated using xmACIS output in Table 1. Presently, the Washington, DC record at National Airport, extends back to 1948. With ThreadEx, daily extremes will be extended back to the 1890s using pre-1948 Weather Bureau station observations, allowing climate perspectives inquiries such as determining the coldest/warmest/wettest Inauguration Day for a substantially longer period of record.

• Another data set containing summary tables for extremes will be produced. This will consist of the top 3 records per calendar day for maximum temperature (highest and lowest), minimum temperature (highest and lowest) and precipitation (highest). Metadata will consist of station information for the station fragments composing the thread. The period of analysis will consist of the earliest data available in digital form through the end of 2004.

Table 1. Sample xmACIS Output

WASHINGTON REAGAN NATIONAL AP (KDCA)
Extremes
Lowest Average Minimum Temperature
Days: 1/20 - 1/20
Length of period: 1 day
Years: 1948 - 2004

Rank	Value	Ending Date
1	-2.0	1/20/1985
2	8.0	1/20/1994
3	9.0	1/20/1984
4	16.0	1/20/1983

4. FUTURE DEVELOPMENT AND UPDATE

A national oversight committee will be established to oversee future updates to the Threaded Extremes Data Set. This committee will seek to include members representing the Regional Climate Centers, AASC, NCDC, NWS field offices, NWS regional offices and NWS Headquarters. This committee will also be charged with making determinations in situations where a partner requests an exception be made to the methodology outlined above.

Both the xmACIS and table derivatives of the data set will be updated on an annual basis to include calendar year updates and extension of period of record based upon digitized daily data rescued from NOAA archives and offices as they are documented (including metadata such as latitude, longitude, elevation, station/instrument and other siting characteristics, *etc.*), quality assured, and made available.

5. CONCLUSION

NOAA's commitment to excellence in climate services is punctuated by its synergies with partners in developing data feedback, quality assurance, and dissemination infrastructure. With the ThreadEx effort, maximized, consistent, updated daily extremes will be available for government, partner, and general public (especially media) use. The consistent use of such information will make clear regional extremes and lay the foundation for the expansion of this technique to additional locations and parameters.

6. REFERENCES

Guttman, N. B., 2002: Digitization of historical daily cooperative network data. Preprints, *13th Conf. on Applied Climatology*, Portland, OR, Amer. Meteor. Soc., 43–46.

DeGaetano, A. T., R. J. Allen, and K. P. Gallo, 2002: A homogenized historical temperature extreme dataset for the United States. *J. Atmos. Oceanic Technol.*, **19**, 1267–1284.

Kunkel, K.E., K. Andsager, G. Conner, W.L. Decker, H.J. Hillaker, Jr., P. Naber Knox, F.V. Nurnberger, J.C. Rogers, K. Scheeringa, W.M.Wendland, J. Zandlo, Jr., and J.R.Angel, 1998: A daily dataset for climatic resources applications in the Midwest, *Bulletin of American Meteorological Society*, **79**, 1357-1366 .

Trenberth, K.E. and T. W. Owen, 1999: Workshop on indices and indicators for climate extremes, Asheville, NC, USA., 3-6 June 1997: Breakout Group A: Storms. *Climatic Change*, **42**, 9-21.

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